

CLAIMS

1. A propulsion apparatus for transport of accessory devices within body cavities or canals, sections of pipe, lumens, and other generally tubular spaces and environments, comprising:

5 a toroid, the toroid being a fluid-filled, enclosed ring formed of a flexible material, the enclosed ring defining a central cavity, having an interior volume and presenting an exterior surface and an interior surface which move continuously in opposite directions when the apparatus is in motion;

10 a frame formed of a support structure located within the interior volume of the enclosed ring, a housing structure concentrically and coaxially located relative to the support structure and disposed in the central cavity of the enclosed ring; and

15 a series of at least two sets of interlocking rollers or skids located on the support and housing structures, the rollers or skids being located so as to maintain the two structures in a fixed spatial relationship with the flexible material of the enclosed ring being positioned between the two structures and the rollers or skids located thereon.

2. The apparatus of claim 1, further comprising at least one accessory device.

3. The apparatus of claim 1, further comprising a power source connected to the rollers which when powered provide a motive force to the flexible material of the enclosed ring.

4. The apparatus of claim 3, wherein the power source is an external power source.

20 5. The apparatus of claim 3, wherein the power source is an internal power source.

6. The apparatus of claim 1, wherein the flexible material is a polymeric material.

7. The apparatus of claim 1, further comprising a power source for powering the rollers, and at least one accessory device.

25 8. The apparatus of claim 1, further comprising an accessory tube, the tube having at least one pathway through which accessory devices can be inserted or connected to external supporting devices.

9. The apparatus of any one of claims 2, 7 or 8, wherein the at least one accessory device is selected from the group consisting of endoscopes, cameras, fiber optic cables, electronic communication cables, lasers, surgical instruments, medical instruments, 30 diagnostic instruments, instrumentation, sensors, stent catheters, fluid delivery devices, drug delivery devices, electronic devices, tools, sampling devices, assay devices, other accessory devices, and combinations thereof.

10. The apparatus of claim 1, further comprising a worm gear.

11. The apparatus of claim 1, wherein at least one of the rollers is suspended by a spring.

12. The apparatus of claim 1, wherein at least one of the rollers is rotatably supported by an arm.

13. A propulsion apparatus for transport of accessory devices, comprising:

5 a toroid, the toroid being a fluid-filled, enclosed ring formed of a flexible material, the enclosed ring defining a central cavity, having an interior volume and presenting an exterior surface and an interior surface which move continuously in opposite directions when the apparatus is powered;

10 a frame formed of a support structure located within the interior volume of the enclosed ring, a housing structure concentrically and coaxially located relative to the support structure and disposed in the central cavity of the enclosed ring;

a series of at least two sets of interlocking rollers or skids located on the support and housing structures, the rollers or skids being located so as to maintain the two structures in a fixed spatial relationship with the flexible material of the enclosed ring being positioned

15 between the two structures and the rollers or skids located thereon;

an accessory tube, the tube having at least one pathway through which accessory devices can be inserted or connected to external supporting devices;

at least one accessory device inserted through the accessory tube or connected through the accessory tube to at least one external supporting device; and

20 a power source connected to the rollers which when the apparatus is powered provide a motive, directional force to the flexible material.

14. A propulsion apparatus for transport of accessory devices, comprising:

a toroid, the toroid being a fluid-filled, enclosed ring formed of a flexible material, the enclosed ring defining a central cavity and having an interior volume;

25 a powered frame formed of a support structure located within the interior volume of the enclosed ring, a housing structure concentrically and coaxially located relative to the support structure and disposed within the central cavity of the enclosed ring, a series of at least two sets of interlocking rollers or skids located on the support and housing structures, the rollers or skids being located so as to maintain the two structures in a fixed spatial
30 relationship with the flexible material of the enclosed ring being positioned between the two structures and the rollers or skids located thereon, the rollers being connected to a power source and when powered providing a motive, directional force to the flexible material.

15. An endoscopic, medical procedure; comprising the steps of:

introducing a self-propellable, endoscopic apparatus into the rectum and anal canal of a patient, the apparatus being equipped with at least one accessory device and connected to at least one external support device;

powering the apparatus to propel the apparatus forward through the anal canal and
5 into the colon up to a location in the colon at which at least one medical procedure is to be performed;

performing the at least one medical procedure with the at least one accessory device;
optionally, serially propelling the apparatus to another location in the colon at which
the at least one medical procedure is to be performed and performing said at least one

10 medical procedure;

propelling the apparatus backward through the colon and into the anal canal; and
removing the apparatus from the patient.

16. An endoscopic, medical procedure; comprising the steps of:

introducing a self-propellable, endoscopic apparatus into the rectum and anal canal of
15 a patient, the self-propellable endoscopic apparatus comprising:

a toroid, the toroid being a fluid-filled, enclosed ring formed of a flexible material, the enclosed ring defining a central cavity and having an interior volume; a powered frame formed of a support structure located within the interior volume of the enclosed ring, a housing structure concentrically and coaxially located relative to the support structure and disposed within the central cavity of the enclosed ring, a series of at
20 least two sets of interlocking rollers or skids located on the support and housing structures, the rollers or skids being located so as to maintain the two structures in a fixed spatial relationship with the flexible material of the enclosed ring being positioned between the two structures and the rollers or skids located thereon, the
25 rollers being connected to a power source and when powered providing a motive, directional force to the flexible material; and at least one accessory device and connected to at least one external support device;

powering the apparatus to propel the apparatus forward through the anal canal and
into the colon up to a location in the colon at which at least one medical procedure is to be
30 performed;

performing the at least one medical procedure with the at least one accessory device;

optionally, serially propelling the apparatus to another location in the colon at which the at least one medical procedure is to be performed and performing said at least one medical procedure;

propelling the apparatus backward through the colon and into the anal canal; and

removing the apparatus from the patient.

17. An endoscopic procedure; comprising the steps of:

introducing a self-propellable, endoscopic apparatus into the generally tubular space or environment, the apparatus being equipped with at least one accessory device and connected to at least one external support device;

powering the apparatus to propel and navigate the apparatus forward in the tubular space to a location at which at least one endoscopic procedure is to be performed;

performing the at least one endoscopic procedure with the at least one accessory device;

optionally, serially propelling the apparatus to another location in the tubular space at which the at least one endoscopic procedure is to be performed and performing said at least one endoscopic procedure;

propelling the apparatus backward through tubular space; and

removing the apparatus from the tubular space.